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Catches of rice planthoppers and their common predators by light traps at various periods of operation. MARDI, Malaysia.

Time period	Catches (%)			
	Nilaparvata lugens	*Sogatella furcifera*	*Cyrtorhinus lividipennis*	*Paederus fuscipes*
1830–1930	28.0	88.0	23.3	10.0
1930–2030	56.0	4.0	67.2	70.7
2030–2130	6.4	2.0	4.8	7.5
2130–2230	4.6	6.0	2.5	4.2
2230–2330	5.0	0.0	2.2	7.6

way to separate and conserve the *Cyrtorhinus* merits serious consideration. But with *P. fuscipes,* the predator:BPH ratio is generally less than 1, averaging 0.8 and ranging from 0.3 to 1.1.

The findings indicate that the critical period for using light traps against the BPH is early evening. For maximum catches, the traps should operate between 1830 and 2030 hours.

Fate of carbofuran in flooded soil and in rice plants

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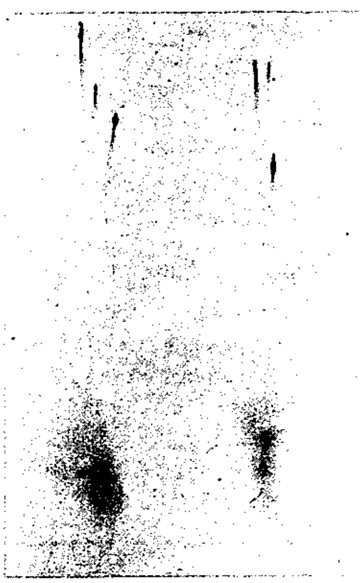
The decreasing effectiveness of carbofuran in the control of brown planthoppers (BPH) – but not leafhoppers – has been reported in some IRRI trials. Effectiveness was lowered particularly when granular formulations were broadcast into paddy water. Root-zone applications (RZA) have been reported superior to paddy water applications (PWA). Therefore, studies were conducted on the persistence in soil and absorption and movement of ring-labeled ^{14}C-carbofuran in rice plants. Also, the effects of PWA and RZA were compared.

Twenty-five-day-old IR8 seedlings were grown in a greenhouse in Maahas clay soil (pH 5.9) treated with labeled carbofuran solution either applied directly to the paddy water or injected into the root zone with a syringe (near the roots and approximately 3 cm below the surface of flooded soil).

Periodic analysis of radioactivity revealed that the persistence of carbofuran in soil was higher in RZA than in PWA. But plant uptake was more rapid with PWA, apparently because the penetrating insecticide provided easy accessibility to roots near the soil surface. Plant uptake with PWA reached a maximum level in 1 week; that with RZA increased gradually. Most of the carbofuran absorbed by the rice plant was found in leaf blades and roots; only small quantities were found in stems and leaf sheath (see photo). That partly explains the decreased effectiveness of carbofuran for control of BPH, which feeds on leaf sheaths, but not of leafhoppers, which feed on leaves. Carbofuran and its breakdown products are transported acropetally to leaf tips, possibly by the transpiring water. Furthermore, the radioactivity observed in dewdrops collected on leaf blades suggests that carbofuran may be lost by vaporization.



Autoradiograph showing the location of carbofuran in rice plants. Carbofuran was applied to the paddy water. Note the carbofuran concentrating in the leaf tips and the tendency to vaporize into the air. Print from X-ray film.

The radioactivity balance sheet prepared by growing rice plants in culture solution containing ^{14}C-carbofuran showed that almost 87% of the absorbed carbofuran could not be accounted for either in the plant or in the culture solution in a 20-day period. The insecticide was apparently lost to the atmosphere.

More direct evidence of vapor loss of carbofuran was obtained by trapping the circulating air in a controlled growth chamber. Carbofuran was detected in the trap as early as 24 hours after treatment. The loss of radioactivity was directly related to the amount of water lost through transpiration.

Carbofuran losses in rice were more rapid with PWA than with RZA. That was evidently related to the rate of carbofuran uptake and its persistence in the soil in the two application methods.

We conclude that better BPH control by carbofuran as RZA reported by other workers could be because the insecticide is continuously available due to its increased persistence in the soil. The rice plant may lose appreciable quantities of the insecticide through vaporization.

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Aphids as rice pests in Sierra Leone

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The plum peach aphid *Hysteroneura setariae* and the root aphid *Tetraneura nigriabdominalis* emerged as rice pests in Sierra Leone in the early 1976 wet season when they were found feeding on various parts of upland rice plants. Since then, the plum peach aphid has been observed feeding on the leaves and unripened grains of some rice varieties in association with an unidentified ant. The root aphid feeds on rice roots.

The adults of the wingless *H. setariae* are about 3 to 4 mm long. When fully grown, they have a rust to dark-brown color. The young are pinkish. The aphid appears to emerge with the onset of May rains and remains until the weather dries in December. But heavy rains from August to October appear to greatly reduce the aphid population.

The adults suck sap from leaves or from unripe grains. Moderately infested grains show brown, necrotic spots. A heavy infestation can result in completely brown, empty spikelets. Among rice varieties on which aphids have been observed feeding, the most susceptible appear to be Moroberekan, IAC25, LAC23, CP4, IRAT13, and Iguape Cateto. A wide range of graminaceous plants serve as alternate hosts. Those identified are *Echinochloa crusgalli, Eleusine indica, Pennisetum subangustum, Digitaria longiflora, Panicum laxum, Sorghum bicolor, Ischaemum rugosum, Sporobolus pyramidalis,* and *Paspalum commersonii.*

Mature adults of the root aphid measure about 3 to 5 mm long. They are more or less spherical and generally brown in color. The body is almost always enveloped in a thin film of white powder.

The mature adults seem to emerge and infest rice roots simultaneously with the plum peach aphid in April or May. About 70% of its occurrence seems to coincide with the infestation of rice by termites, among which *Pericapritermes socialis* is most abundant.

Grasses that serve as alternate hosts of *T. nigriabdominalis* include *E. indica, P. subangustum, I. rugosum,* and *Paspalum commersonii.* They are the most common and persistent in the upland ecologies of Sierra Leone and constitute the greatest weed competitors of rice. Their control or elimination, or both, has become more urgent in view of their association with the two aphids.

The weed alternate hosts were identified by H. M. Bernard, Plant Physiology Department, Rice Research Station, Rokupr, Sierra Leone. Dr. V. Calilung of the University of the Philippines at Los Baños, and the Commonwealth Institute of Entomology, London, England, identified the aphids reported in this paper.

Insect pests of summer paddy in Madhya Pradesh, India

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The cultivation of paddy in summer (Jan.–June) has recently become popular with farmers who have irrigation resources such as wells and tanks. The summer crop normally yields higher than the main kharif (June–Oct.) crop. Because insects are usually negligible, monetary returns are higher and pesticide costs are lower. During kharif, yields are lower and severe insect problems necessitate pesticide treatments.

Farmers erroneously believe they can grow paddy almost pest-free in the summer. But a survey of summer paddy in May and June 1978 indicated that the hills of transplanted Ratna, Madhuri, R2895, IR22, Anupama, Kranti, CR44, RN1, and Patel 85 suffered from gall midge *Orseolia oryzae* attack to the extent of 23.2, 21.3, 0.0, 7.8, 6.1, 1.7, 34.6, 2.9, and 16.0%, respectively. Tiller infestation was 3.1, 7.5, 0.0, 0.9, 1.3, 0.2, 8.0, 0.4, and 2.7%, respectively. Gall midge parasitism was low: 5.3% in Ratna and 14.3% in CR44. It appears that transplanting beyond March provided an opportunity for continuity and spread of gall midge because it linked the summer and kharif crops. Gall midge damaged from 36 to 92% of the hills in kharif.

The stem borer *Tryporyza incertulas* affected 1.5, 1.2, and 4.4% of the tillers in Ratna, IET3232, and Anupama, respectively. The population of long- and short-horned grasshoppers was 22, 10, 44, and 14/25 sweeps of a standard hand net on Ratna, Madhuri, IR22, and IET3232, respectively.

The number of green leafhopper *Nephotettix* spp. captured per 25 sweeps was 5, 4, 10, and 4 on Ratna, IR22, R2895, and IET3232, respectively. The brown planthopper *Nilaparvata lugens* infested summer paddy in stray fields, ranging in number from 12 to 30/hill and averaging 18. The average 100-grain weight from fields severely and lightly infested by *N. lugens* (ranging from 1 to 6/hill, with an average of 1.6) was 2.27 and 2.21 g, respectively.

The density of the cutworm *Mythimna separata* varied from low to a high of 98 caterpillars/m^2. Five larvae per hill in Kranti were estimated to cut and shed 55 grains weighing 1.04 g.

Soil and crop management

Nitrogen-variety trial in rice

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A field trial was conducted on a black clayey soil with low organic matter content, medium phosphorus pentoxide (P_2O_5), high potassium oxide (K_2O), and a pH of 7.5 during rabi (Nov.–April) 1977 at the Rice Research Unit, Agricultural College Farm, Bapatla, Andhra Pradesh. Two rices – a prerelease line, BPT1235 (125 days duration), and RP4-14 or Prakash (130 days) – constituted the main plots, and combinations of 3 nitrogen levels and 3 methods of split nitrogen application were the subplots and sub-subplots, respectively, in a split plot design with 3 replications. A basal application of 60 kg P_2O_5/ha and 30 kg K_2O/ha was applied.

BPT1235 yielded better than RP4-14 (see table). Nitrogen applications progressively increased the yield of RP4-14; the optimum nitrogen level for BPT1235 was 100 kg/ha. Differences among the three methods of split application were not statistically significant.